

## Notice of Interest

### Description:

**Proposal Disallowed Reason:** This Notice of Interest concerning the release of a Broad Agency Announcement (BAA) to solicit research and development (R&D) is issued in accordance with 10 CFR 600 and 48 CFR Part 35.016. Proposers should not submit a proposal in response to this Notice of Interest, but may submit a proposal after release of a solicitation at a later date. Solicitation Number: TBD.

**Description:** The Air Force Research Laboratory (AFRL), the National Nuclear Security Administration (NNSA) and the Army Space and Missile Defense Command (SMDC) will be jointly soliciting proposals for R&D to improve national capabilities to detect, locate, and identify nuclear explosions. It is anticipated that this solicitation will be released on or about July 30, 2004 and closed on or about October 1, 2004 seeking proposals with a period of performance of 1-3 years. The objective of the solicitation will be to advance the state-of-the-art in seismic, hydroacoustic, infrasound and radionuclide methods of nuclear explosion monitoring. This will be achieved through basic and applied research that enhances understanding of the underlying phenomena, proposes new methods of tackling monitoring problems, or develops new data of use in nuclear explosion monitoring. Where appropriate, priority will be given to studies of propagation conditions in Eurasia.

Research products developed under this solicitation shall support Air Force requirements for improving the Nation's capabilities to monitor nuclear explosions. Information about the NNSA Nuclear Explosion Monitoring Research & Engineering (NEM R&E) program integration of research products into operational form for the Air Force can be found online at <https://www.nemre.nnsa.doe.gov/nemre/KnowledgeBase>.

Research is being sought in the following topic areas:

**TOPIC 1:** Energy partition and propagation for local and regional seismic phases including effects on magnitudes and effects of source physics;

**TOPIC 2:** Calibration and Ground Truth Collection;

**TOPIC 3:** Seismic Detection, Location and Discrimination;

**TOPIC 4:** Infrasound;

**TOPIC 5:** Hydroacoustic studies; and

**TOPIC 6:** Radionuclide studies.

The objective of this solicitation is to enhance U.S. capabilities in nuclear explosion monitoring primarily with ground-based systems. This will be achieved through advances in the state-of-the-art for nuclear explosion monitoring, basic and applied research that enhances understanding of the underlying phenomena, developing new methods of tackling monitoring problems, or developing new data of use in nuclear explosion monitoring. Field experiments may be proposed.

Each of the topic areas is described below. Individual proposals should be directed to only one topic area, but the Proposer may submit proposals in more than one topic area. All topic areas are of importance. However, depending on the proposals received and programmatic needs, funding will not necessarily be distributed evenly among the topic areas.

### **Topic 1 (Energy Partition and Propagation for Local and Regional Seismic Phases Including Effects on Magnitudes and Effects of Source Physics)**

Proposals are sought complementing existing efforts to answer the question of how seismic energy is generated from underground phenomena (including distributed and single point explosions, double-couple earthquakes and other modes of rock failure), how this energy is partitioned between P and S waves, and how it propagates to regional distances (less than 2,000 km). Generation of S waves from explosions is of particular interest, as are models of the source, both theoretical and empirical. Theoretical and empirical models should address the generation and partitioning of the seismic energy and the effect of properties such as 1) source region medium and overburden, 2) the local structure, and 3) the surrounding tectonic province. For experimental observations, the question of how to design an experiment that will answer the questions posed throughout this topic is of interest; a particular concern is measurement of downgoing energy at the source that contributes to Lg downrange. Also of interest are observational and experimental studies of small shallow earthquakes, especially high stress drop events, such as in mines. Proposals on the possible effects of frozen hard rock on explosive coupling that complement ongoing efforts are of interest.

In propagation, the influence of 3D laterally varying structure, including laterally varying vertical velocity gradients, and 3D scattering on the stability of propagation of Pn, Pg, Sn, Lg is of interest. New methods of estimating the yield of a fully coupled explosion, and how emplacement conditions affect the observation, are of interest. Proposals for theoretical and observational investigations, including empirical source models and mine investigations will be accepted under this topic. In addition, proposals for improved modeling of waveforms at local, regional, and near-teleseismic distances will be considered.

### **Topic 2 (Seismic Calibration and Ground Truth Collection)**

Proposals for dedicated GT0 calibration explosions are of high interest, especially reciprocal calibration shots. Collection of location ground truth at a GT5 level or better is sought for events of magnitude 2.5 and larger. Such high-quality ground truth events (with absolute location and depth errors less than 5 kilometers) might be obtained from: a) dense local networks, b) instrumented mines, c) remote sensing, and d) other techniques. Special consideration will be given to remote sensing techniques for ground truth collection applicable to regions that are difficult or impossible to access. Proposals that specifically address uncertainties in the acquired ground truth information are desirable.

Geophysical studies that generate new discrimination ground-truth events with source geometry information are sought, such as shallow earthquakes, mining explosions or mining-related collapse studies. Proposals are sought to develop models that calibrate earth velocity and attenuation structure, especially in aseismic regions. Calibration of regional coda magnitudes is of interest. Improved Q models with emphasis on regional phases Pn, Pg, Sn, Lg and surface waves are desirable. Priority will be given to studies of propagation conditions in Eurasia. Particular emphasis will be placed on procedures that develop models by fitting multiple datasets (e.g. body and surface wave tomography, receiver functions, refraction data, gravity, etc.), and procedures that estimate the uncertainty of geophysical models. Proposals are also sought that characterize transition zone propagation, i.e. mapping and calibrating travel time and amplitude behavior of P and S waves traveling through the transition zone (ray bottoming

depths from the Moho to 660 km, and distance ranges from 13 to 30 degrees).

Proposals for development of methods to transfer existing geophysical calibration information (e.g., travel-times, attenuation, etc.) from open seismic stations to new or planned stations and arrays in the monitoring network are of interest.

### **Topic 3 (Seismic Detection, Location, and Discrimination)**

New and innovative seismic signal processing methods are sought with potential to significantly lower the thresholds at which detection, location and identification functions can be performed at acceptable false alarm rates. Methods from other areas of seismology such as volcano monitoring could be considered. New and innovative methods of array signal processing are solicited that employ calibration or other techniques to enhance signal detection and parameter estimation (e.g. azimuth, phase velocity) in strongly heterogeneous media. Full waveform methods, which include but are not limited to synthetic seismogram matching to data, for seismic event detection, location, and discrimination are of particular interest, especially methods that include the effect of geophysical model uncertainty and tradeoffs between different parameters of geophysical models. Tuning studies, either of specific arrays or of techniques in general, are not sought.

Estimating improvements in detection, including testing of detection processes using superposition of actual signals in increasing noise, is of interest. Improved methods of arrival-time picking and phase identification, especially for local (0-300 km) and far-regional (1500 km and greater) phases are desired. Improved location techniques are sought, especially development and validation of mathematical and geophysical techniques for determining new ground-truth events and earth structure. An example could be combining relative event locations with limited ground-truth constraints (such as fault planes). Proposals for advanced discrimination methods that make significant improvement over current techniques would be of interest, as are new techniques of detecting and validating depth phases for crustal events observed locally, regionally and teleseismically. Proposals to extend existing techniques of discrimination such as Ms:mb to lower level regional signals are of particular interest, as are other possible discriminants using

intermediate period data. Again, tuning studies, either of specific arrays or of techniques in general, are not sought.

#### **Topic 4 (Infrasound)**

Proposals are sought for an improved understanding of the fundamental physics of generation of infrasound from underground contained and near-surface explosions and other sources, of local and regional propagation of infrasound signals from such sources, and of atmosphere dynamics affecting propagation of such signals.

Proposals are sought for an improved understanding of the fundamental physics of the propagation of local, regional and long range infrasound signals, sources, noise and the temporal atmospheric conditions that affect propagation of infrasound acoustic waves. Improved methods of arrival-time, azimuth and phase identification are desired. Focused investigations and or field calibration experiments using man-made sources and natural phenomenon are desired.

#### **Topic 5 (Hydroacoustic for Discrimination of Underwater Seismic Events)**

Proposals are sought that investigate the physics of long-range hydroacoustic propagation of high-frequency (>30 Hz) energy through the Antarctic convergence zone, by hydroacoustic coastline reflection, and through and around blockages. Observational, experimental, and theoretical studies are of interest; studies that combine data with theory are of particular interest for potential discrimination of underwater seismic events.

#### **Topic 6 (Radionuclide )**

Proposals are sought to investigate ways in which gaseous and particulate radionuclide collection, detection, and measurement can be improved. Possible areas of research include the development of ways to improve the understanding of microscale and mesoscale radionuclide transport; the state of the art of radionuclide collection media and other hardware; the capabilities of present-day ground-based radionuclide collection, detection, and quantification systems; and the preprocessing and post processing of radionuclide monitoring data. Possible results of proposed research studies include but are not limited to movement towards novel, efficient detection

systems that collect a broad range of radionuclides; methods and processes that facilitate improved data discrimination; innovative, cost effective ways to detect the presence of specific radionuclides; methods to improve the quantification of radionuclides in the presence of high backgrounds; accurate, precise ways to identify the source location, emission mechanism, and quantities of radionuclides emitted based upon ground-based measurements; methods to correlate specific radionuclide measurements with certain source materials and processes; and or ways to capitalize off biological and chemical processes that can facilitate radionuclide detection and measurement is also desired. Proposals must state the expected sensitivity, the functional range and the proposer's assumed method of usage for proposed technology that would be developed based on the proposed work (as a classified appendix if appropriate).

After the solicitation is released, proposals must be submitted for either a contract or a financial assistance award. However, AFRL, NNSA and SMDC will reserve the right to determine which procurement instrument shall be used. The instrument shall be appropriate to the scope of work and performing organization. NNSA may issue contracts or financial assistance awards, or both. The Air Force and Army will issue contracts only. If a contract is issued, acquisition regulations apply per 48 CFR, and a cost reimbursement contract is anticipated. If a financial assistance award is used, 10 CFR 600 applies, and a cooperative agreement is anticipated.

The BAA will solicit proposals from all responsible organizations (foreign and domestic) including industry, academic institutions, research institutions, and non-profit organizations. Federal agencies may submit proposals as prime/lead contractors subject to appropriations language but may not partner with Federally Funded Research and Development Centers (FFRDC). FFRDCs, including NNSA national laboratories, cannot directly respond to this solicitation as prime/lead participants. FFRDCs, including NNSA national laboratories, may participate in this solicitation as team members; however, such participation must be consistent with the FFRDCs sponsoring agreement. Links to websites that contain the full text of these regulations are provided in this Industry Interactive Procurement System (IIPS) Information announcement. The FFRDC effort for any proposal, in aggregate, shall not exceed 50% of the total effort of the project. Information will be provided in the solicitation on how

to include FFRDCs such as NNSA national laboratories in this solicitation as team members.

The NNSA, AFRL and SMDC each reserve the right to fund, in whole or in part, any, all or none of the proposals and to award without discussions. All awards will have an NNSA Product Integrator (subject matter expert) assigned at the time of award to help ensure maximum value to the US Government of research products successfully transitioning to operations as appropriate. If teaming arrangements are proposed, technical approach, deliverables and

costs must be clearly separable for individual team members as the Government reserves the right to award to the team or to individual team members.

This Notice of Interest is being issued in advance of passage of fiscal year 2005 appropriations to provide more time for potential proposers to prepare and to allow awards to be made as early as possible within the 2005 fiscal year. The topics in this Notice of Interest represent the maximum set of topics that may appear in the solicitation. The final number of topics and awards, however, are subject to the availability of funds.

**General Information:**

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